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Does team competition eliminate the gender gap in entry in competitive environments?*

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Abstract This paper studies the impact of the possibility to enter a tournament as a team on the gender gap in tournament entry. While a large and significant gender gap in entry in the individual tournament is found in line with the literature, no gender gap is found in entry in the team tournament. While women do not choose to enter the tournament significantly more often when it is team-based, men enter significantly less as part of a team than alone. Changes in overconfidence as well as in risk, ambiguity and feedback aversion, the difference in men and women's taste for the uncertainty on their teammate's ability all account for a part of the disappearance of the gender gap in tournament entry. A remaining explanation is that being part of a team changes men and women's taste for performing in a competitive environment.

Résumé Ce papier étudie l'impact de la possibilité d'entrer en équipe dans un tournoi sur la différence hommes-femmes dans la décision d'entrer. Alors qu'en adéquation avec la littérature, une grande différence hommes-femmes dans la décision d'entrer dans le tournoi individuel est trouvée, il n'y a plus de différence dans la décision d'entrer dans le tournoi en équipe. Ce changement n'est pas dû au fait que les femmes entrent plus en équipe que seules mais au fait que les hommes entrent nettement moins dans le tournoi en équipe que dans le tournoi individuel. L'impact différent pour les hommes et les femmes du passage d'un tournoi individuel à un tournoi en équipe sur leur surconfiance, leur aversion au risque, à l'ambiguité et au feedback expliquent en partie pourquoi les hommes et les femmes choisissent dans des proportions similaires le tournoi en équipe alors que ce n'était pas le cas pour le tournoi individuel. Un autre facteur explicatif réside dans une réaction différente des hommes et des femmes à l'incertitude sur le niveau de leur coéquipier. L'explication résiduelle est que le fait de faire partie d'une équipe augmente le goût des femmes pour la compétition et diminue celui des hommes.
JEL Codes: D81, C91. **Keywords:** Gender Gap, Tournament,Teams

1 Introduction

The existence of a gender gap in income and social positions in the american and european labor markets is a well known and documented fact. De la Rica et al. (2008) showed that for highly educated workers the wage gap increases as one moves up the distribution. Using a sample composed of a large group of US firms Bertrand and Hallock (2001) found that only 2.5% of the executives in their sample were women. This under-representation of women at high levels of the hierarchy may have several explanations among which a lower ability or the fact that they could suffer from discrimination (Goldin, 1990). The explanation explored in the present paper is a difference between genders in the taste for evolving in competitive environments. Fox and Lawless (2004) showed that women who share the same personal characteristics and professional qualifications as men express significantly lower levels of political ambition to hold elective office.

A recent research literature in experimental economics uses laboratory experiments to study the gender gap in the propensity to enter competitive environments (Gneezy and Rustichini, 2004, Niederle and Vesterlund, 2007, Niederle et al., 2007). The main idea is to compare subjects' choices between a remuneration which does not imply competition, i.e. a piece rate, and one that does, i.e. a tournament. It is then found that women choose to enter the tournament far less often than men resulting in a male-dominated pool of entrants. More precisely, low-performing men enter the tournament too much while high-performing women do not enter enough in comparison with payoff-maximizing choices. Not only the gender gap in tournament entry prevents from achieving diversity at the top of hierarchies, it also has a negative impact on the average performance of candidates for these top-level positions (i.e. entrants in the tournament in my experimental setting). This situation detrimental to welfare calls for measures to urge highly able women to enter competitions more often while discouraging men of low ability to do so.

Different explanations may account for this gender gap in tournament entry: differences in performance, in overconfidence, in risk and ambiguity aversion. The controlled experimental design of Niederle and Vesterlund (2007) allows to disentangle the respective explanatory power of these different factors. The results brings to light that, except for the difference in performance, each of these factors helps explain part of the gender gap. However, after adding all of these controls, a substantial gap remains which must be attributed to a difference between genders in the taste for performing under

the pressure of competition.
This paper explores the lead of teams as a way to reduce the gender gap in tournament entry. It allows at the same time to further explain why men enter tournaments more often than women. Numerous experimental results sugggest that team decision-making may induce more rational behaviors (Cason and Mui, 1997, Bornstein and Yaniv, 1998, Cooper and Kagel, 2005, Kocher and Sutter, 2005). The notion of team used in the present paper is a minimal one: a participant only knows that if he chooses to enter the team tournament he will be randomly matched with someone who made the same choice and that if their average performance beats the average performance of their 2 opponents they will both receive 1 euro times their average performance. However, he will not know who his teammate is or have any information abour him or her. One can nevertheless expect an effect of the tournament being team-based rather than individual on participants' decision to enter and more precisely on the gender gap in tournament entry.
First of all, the tournament being team-based rather than individual changes one's expected payoff from entering the tournament for each level of performance. Nevrtheless, as the probability changes in the exact same way whether you are a man or a woman, one can rule out the possibility that this change of probability might cause a reduction in the gender gap in tournament entry.
Second of all, Niederle and Vesterlund (2007), Niederle et al. (2007) found a significant gender gap in overconfidence. It could be the case that overconfidence about one's team chances to win the tournament differs from overconfidence about one's chances to win the individual tournament. Tajfel (1970) discovered that groups formed on the basis of almost any distinction are prone to ingroup bias. Within minutes of being divided into groups, people tend to see their own group as superior to other groups. It could be the case that men and women differ in how they are affected by this ingroup bias. Women could for example be more optimistic than men about their teammate's performance.
Third of all, being part of a team could have a different effect on men and women's ambiguity, risk or feedback aversion.
Team and individuals do not have the same risk preferences. Shupp and Williams (2007) found that the variance of risk preferences is generally smaller for groups than individuals and the average group is more risk averse than the average individual in high-risk situations, but groups tend to be less risk averse in low-risk situations. Rockenbach et al. (2007) showed that compared

to individuals, teams accumulate significantly more expected value at a significantly lower total risk. Being part of a team may have a different impact on men and women's risk preferences. Women could for example be less risk averse as part of a team than alone.
Fourth of all, in a team competition one's performance influences one's teammate's payoffs and one's payoffs are influenced by one's teammate's performance. For instance, if my teammate is worse than I am, it will lower both my probability of winning the tournament and my payoff if we do win. Charness and Jackson (2008) explore play between groups where one member of each 2-person group dictates the play of that group and is therefore responsible for the payoff of the other group member. They find that a substantial part of the population plays a less risky strategy when choosing for a group than when playing only for herself. Again, men and women may react differently to this responsability issue.
Last of all, the taste for competing might change depending on whether one is part of a team or alone. Niederle and Vesterlund (2007) found that women and men differ in their taste for performing in a competitive environment. Namely, overconfidence, risk and feedback aversion put aside, men like performing in a competitive environment more than women. The fact that the tournament is no longer an individual one could have a different impact on men and women's thrill or fear of competition. Indeed, a literature interested in gender differences in economic decisions (Eckel and Grossman, 1998, 2001, 2008, Ortmann and Tichy, 1999) finds that women tend to be more socially-oriented and less individually-oriented than men as well as more cooperative and less selfish.
For all these reasons, one may think that women may be more drawn to competition when part of a team than alone. For instance, in research, women may feel more comfortable entering the competition of publication with a coauthor rather than by themselves. One can also think that a way to encourage more women to apply to high-profile jobs or top-positions universities would be to advertise that it will imply a lot of teamwork in the future.
A controlled experimental design built on that of Niederle and Vesterlund (2007) is used where participants have to solve a real-effort exercise under various compensation schemes some involving competition (alone or as part of a team) while others do not. The basic idea is to have participants make a choice between a piece rate and a tournament either individual or team-based before they have to perform.
I find that when the tournament is team-based no gender gap in entry is ob-

served while in line with Niederle and Vesterlund (2007) and Niederle et al. (2007), henceforth NV and NSV, an important gender gap is found in the individual tournament entry. While women enter as often alone as when part of a team, men enter significantly less often when part of a team.
The design of the experiment allows to disentangle the role played by several factors in explaining the disappearance of the gender gap in entry. The tournament being team-based rather than individual may have a different impact on men and women's confidence on their chances to win, as well as on their risk, ambiguity and feedback aversion. Men and women may also react in a different way to the uncertainty surrounding their teammate's ability. Each of these factors account for a part of the disappearance of the gender gap in tournament entry. Nevertheless, they do not explain all of it. The remaining explanation must be that being part of a team changes how men and women like to perform in a competitive environment.
From a welfare perspective it seems advisable to attempt to obtain a more equal representation of men and women among participants who choose the tournament and, as much as possible, to have the highly able participants enter the competition. It is then important to prompt high-performing women to enter while discouraging low-performing men to do so. Team tournament helps getting a gender-balanced pool of entrants but it negatively affects its quality as high-performing men are driven away from the Team Tournament by the uncertainty on their teammate's ability. My results seem to suggest that high-performing men's distate for the Team Tournament comes from their not wanting to help a less deserving participant get a higher payoffs and they seem ready to give up some of their payoffs to prevent that from happening. As a result, a way of achieving both an equal representation of genders among entrants and a good quality of the pool of competitors is to provide information about one's teammate's level so that one knows that he will be matched with a participant of about his level if he chooses to enter the team tournament.
The rest of this paper is organized as follows. Section 3 presents the experimental design. The results are given in section 3. Section 4 studies the consequences on welfare of the type of tournament. Finally, section 5 provides some concluding remarks.

2 Experimental Design

The experimental design builds on that of NV. The exercise subjects were asked to perform is the same as in NV: additions of five 2-digit numbers. Such an exercise can be considered as somehow male-oriented as some people would expect men to outperform women on average. This is not a big concern here as this paper belongs to a literature interested in the real-life issue of the under-representation of women in highly-valued positions were there is indeed a stereotype that men are better suited than women to succeed.
Participants were told that they had to complete 8 tasks of which two would be randomly chosen for payment at the end of the experiment. At the end of each task, participants were informed of their absolute performance (the number of additions they correctly solved) but were not informed of their relative performance until the end of the experiment. In a standard task, participants had to choose between a piece rate and a remuneration scheme involving competition (a tournament) before having 3 minutes to solve as many additions as they could. The compensation schemes available changed between tasks (see table 7 in appendix for a synthesis) and participants were informed of their nature only immediately before performing the task.

2.1 The Tasks

Task 1. Piece Rate: Participants are given the 3 minutes addition exercise. If task 1 is randomly chosen for payment, they receive 50 cents per correct answer.

Task 2. Individual Tournament: Participants are given the 3 minutes addition exercise. If task 2 is chosen for payment, the subject receives 1 euro per correct answer if he solved more additions than his randomly chosen opponent, otherwise he receives nothing.

Task 3. Choice between Piece Rate (PR henceforth) and Individual Tournament (IT henceforth): Before they perform their additions, subjects have to choose whether they want to be paid according to the Piece Rate (50 cents per correct answer) or the Individual Tournament compensation scheme. A participant who selects the tournament receives 1 euro per correct answer if his task 3 performance exceeds the task 2 performance of a randomly chosen opponent, otherwise he receives nothing. Subjects are

competing against a competitive performance of their opponent but the decision to enter the tournament is not affected by beliefs about whether the opponent is going to enter. In addition, it allows to rule out that a participant may not enter because he or she may fear to inflict losses to his or her opponent.

Task 3 bis. Choice between *submitting* task 1 performance to Piece Rate or Individual Tournament: No additions to do here, the performance which will determine the payoff is the task 1 performance. If a participant chooses to submit his task 1 performance to the Piece Rate, he receives 0.5 euro times his task 1 performance. If he chooses to submit his task 1 performance to the individual tournament, he receives 1 euro per addition correctly solved at task 1 if he solved more additions than his randomly chosen opponent, otherwise he receives nothing. Task 3 bis is identical to task 3 (in both cases the tournament is a more risky choice implying more ambiguity and subjecting the participant to a feedback at the end of the experiment concerning whether he beated his opponent) except for the fact that it does not involve a future performance. In particular, the participant who chooses to submit his past performance to the tournament does not have to perform under the pressure of competition. In consequence, any change in behavior between tasks 3 and 3 bis will be attributed to the taste for performing in a competitive environment.

Task 4. Choice between Piece Rate and Team Tournament: Subjects have to choose whether they want to be paid according to the Piece Rate or the Team Tournament. The Team Tournament is a 2 to 2 competition. If a participant chooses the Team Tournament, 2 opponents are randomly drawn among the other participants present in the room. 1 teammate is randomly drawn among the participants who chose the team tournament. This implies that a subject who chooses to enter the Team Tournament knows that his or her teammate will have made the same choice so that both teammate will be competing at the same time against their opponents, facilitating the emergence of a team spirit. If the number of additions solved by one's team during task 4 exceeds the number of additions solved by the opposing team during task 2, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing.

Task 4 bis. Choice between *submitting* task 1 performance to Piece Rate or Team Tournament: No additions to do here, the performance which will determine the payoff is the task 1 performance. If a participant

chooses to submit his task 1 performance to the Piece Rate, he receives 0.5 euro times his task 1 performance. If he chooses to submit his task 1 performance to the Team Tournament, 2 opponents are randomly drawn among the other participants present in the room. 1 teammate is randomly drawn among the participants who chose to submit to the Team Tournament. If the number of additions solved by one's team during task 1 exceeds the number of additions solved by the opposing team during task 1, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing. Task 4 bis is identical to task 4 (considering overconfidence, risk aversion, uncertainty about teammate's ability...) except for the fact that it does not involve a future performance. In particular, the participant who chooses to submit his past performance to the Team Tournament does not have to perform under the pressure of competition. In consequence, any change in behavior between tasks 4 and 4 bis will be attributed to the taste for performing in a team competition.

Task 5. Choice between Piece Rate and Team Tournament with a teammate of the same level (TTid henceforth): If a participant chooses the Team Tournament with a teammate of the same level, 2 opponents are randomly drawn among the other participants present in the room. 1 teammate is attributed among the participants who chose the team tournament: the participant whose task 2 performance was the closest to the participant's own task 2 performance. If the number of additions solved by one's team during task 4 exceeds the number of additions solved by the opposing team during task 2, each teammate receives 1 euro times the average task 5 score of their team. Task 5 resembles task 4 in that the subjects have to choose between a Piece Rate remuneration and a Team Tournament but in task 5 the uncertainty about one's teammate's ability at solving additions (or at least part of it) is taken away. Any difference in behavior between task 4 and task 5 will then be attributed to a reaction to this change.

Task 5 bis. Choice between *submitting* task 1 performance to Piece Rate or Team Tournament with a teammate of the same level: No additions to do here, the performance which will determine the payoff is the task 1 performance. If a participant chooses to submit his task 1 performance to the Piece Rate, he receives 0.5 euro times his task 1 performance. If he chooses to submit his task 1 performance to the TTid, 2 opponents are randomly drawn among the other participants present in the room. 1 teammate is attributed among the participants who chose the team tournament:

the participant whose task 2 performance was the closest to the participant's own task 2 performance. If the number of additions solved by one's team during task 1 exceeds the number of additions solved by the opposing team during task 1, each teammate receives 1 euro times the average score of their team. Otherwise, they receive nothing.

2.2 Belief-assessment Questions

A difference in confidence between men and women may explain a significant part of the gender gap in tournament entry. NV and NSV found that both men and women are overconfident but men are more so. In order to control for differences in confidence both in one's chances to win the Individual Tournament and in one's team chances to win the Team Tournament, participants had to answer belief-assessment questions at the end of the experiment. Participants had to guess the mean task 1 and task 2 performances of the participants in their session. The participants were reminded that during task 4 they had to choose between a piece rate and a team-tournament, for which 2 opponents were randomly drawn among the other participants and a teammate was randomly drawn among the other participants who had chosen the team tournament. They were also told that even if they had chosen the Piece Rate at task 4, 2 opponents and 1 teammate had still been randomly chosen in the exact same way. Their own task 2 performance was reminded to them and participants had to guess the task 2 performances of their teammate and opponents chosen during task 4. The participants were reminded that during task 4 bis they had to choose between submitting their task 1 performance to either a piece rate or a team-tournament, for which 2 opponents were randomly drawn among the other participants and a teammate was randomly drawn among the other participants who had chosen to submit to the team tournament. They were also told that even if they had chosen the piece rate at task 4 bis, 2 opponents and 1 teammate had still been randomly chosen in the exact same way. Their own task 1 performance was reminded to them and participants had to guess the task 1 performances of their teammate and opponents of task 4 bis. A participant knew he would earn 1 euro per correct guess.

3 Results

The experiment was run at the Parisian Experimental Economics Laboratory (LEEP) of Paris 1 University. 39 men and 37 women took part in the experiment. This section presents the results of this experiment. It starts by studying the gender differences in performance and entry in the Individual Tournament providing results in line with NV. Then, the gender differences in entry in the team tournament are explored. Finally, the explanatory power of the different potential explanations for the disappearance of the gender gap in entry are investigated.

3.1 Gender Differences in Performance and in Entry in the Individual Tournament

In this subsection, I check whether there are some gender differences in performance which was the case in NSV but not in NV. I also look at the gender gap in the individual tournament entry. In the present paper, a participant to the individual tournament is the winner if he or she beats one opponent. This one-to-one competition could have an effect on the participants' decision to enter. Men's performances were slightly above women's. In task 1 (piece rate), men solved 5.9 additions on average while women solved 5.6 additions. In task 2 (tournament), men solved 7.4 additions on average while women solved 6.3 additions. These differences are not significant with a two-sided Mann-Whitney test. While men perform significantly better under the tournament than under the piece rate (a two-sided Mann-Whitney test yields p=0.04), it is not the case for women (p=0.34). After having gone through the piece rate and tournament remuneration schemes, participants have to choose which one they want to perform under for task 3. If they choose the tournament, they will be considered the winner if they beat the task 2 performance of their opponent. Considering the true distribution of task 2 performances, a payoff-maximizing participant should choose the tournament if his task 3 performance exceeds 7 (see Figure 14 in appendix: an omniscient participant with a performance above or equal to 7 has higher expected payoffs from the individual tournament than from the piece rate). If the participant's task 3 performance is exactly the same as his task 2 performance, 46% of women and 49% of men have higher expected earnings from the tournament. This predicted gender gap is not significant (a two-sided Mann-Whitney test yields p=0.81).

Like in Niederle and Vesterlund (2007), there is a gender gap in the Individual Tournament entry: 51.35% of women and 84.62% of men chose to enter the individual tournament. This difference is significant with a two-sided Mann-Whitney test (p=0.002). While men enter significantly more than expected (p=0.00), it is not the case for women (p=0.65). However the gender gap in tournament entry is greater for participants with above median task 2 performances. 50% of low performing women and 62% of low performing men chose to enter the individual tournament (a two-sided Mann Whitney test yields p=0.57). Among high performing participants, 52% of women and 96% of men entered the tournament (p<0.01). The first logit regression of Table 1 shows tournament entry as a function of the participant's gender and task 2 performance. High performing participants tend to enter more often but controlling for performance, women enter significantly less often than men.

This gender-gap in tournament entry have several potential explanations: differences in overconfidence between men and women, differences in risk, ambiguity and feedback aversion, differences in the taste for performing in a competitive environment. We start by examining whether men are more overconfident than women as found in NV and NSV. At the end of the experiment, participants' task 2 performance was reminded to them and they had to guess the task 2 performance of their teammate and opponents at task 4. From their answer, their guessed rank was computed and the guessed ranks conditionnal to the actual task 2 performance (4 goups of level were built corresponding each to 25% of participants) were compared.

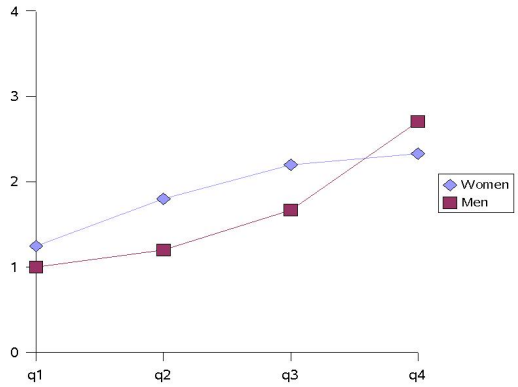

Figure 1. Mean Guessed Rank for each Performance Level

Table 1: Logit of Tournament-Entry Decision (Task 3)

Regressors	(1)	(2)	(3)
Female	-0.29	-0.25	-0.16
	(0.01)	*(0.01)*	*(0.01)*
Perf2	0.05	0.03	0.01
	(0.04)	*(0.19)*	*(0.49)*
Guesswin		0.40	0.33
		(0.01)	*(0.04)*
Submit			0.15
			(0.01)

The table presents marginal effects computed at a man with a task 2 performance of 6.86 which corresponds to the average task 2 performance. p-values are in brackets.

Looking at 1, it seems that both men and women are overconfident but men to a greater extent. An ordered logit regression of the guessed rank yields a negative and significant ($p<0.01$) coefficient of task 2 performance and a positive and significant effect of Female ($p=0.07$). The higher the task 2 performance, the better the participant thinks he is while, for a given performance, men are more overconfident than women.

The second regression of Table 1 shows that the more confident the participant is about winning (guesswin=1 if the participant's guess of the mean task 2 performance is below his own task 2 performance, else guesswin=0), the more prone he is to enter the tournament. Adding this control for this measure of overconfidence, the gender gap in tournament entry diminishes but remains significant. The difference in overconfidence between genders accounts for a part of the gender gap in tournament entry: the fact that women are less confident than men in their chances to win the tournament helps explain why they enter the tournament less often. Nevertheless, when controlling for Task 2 performance and beliefs about winning, women still choose to enter less often than men meaning that the gender gap in entry is not only due to women being less able or less confident than men.

In order to also control for the role of risk, ambiguity and feedback aversion in the gender gap in tournament entry, the task 3 bis decision to submit the task 1 performance to either a piece rate or an individual tournament is used. Indeed, the tasks 3 and 3 bis decisions are the same except for the fact that only in task 3 does the participant actually have to perform in a competitive environment. In consequence, when adding the task 3 bis decision in the

regressors, any remaining gender gap will be attributed to a difference in the taste for performing under a competition. The third regression of Table 1 shows that a participant who chooses to submit his task 1 performance is more likely to choose to enter the individual tournament but a great and significant gender gap remains. The fact that women are more averse to risk, ambiguity and feedback than men helps explain why they enter the tournament less often since the coefficient of Female diminishes when adding the decision to submit to the regressors. Nevertheless, the residual significant gender gap must be attributed to a difference in the taste for performing in a competitive environment between genders. These results are in line with NV and NSV.

3.2 Gender Differences in Entry in the Team Tournament

Like for the Individual Tournament, anyone with higher expected earnings from the Team Tournament than the Piece Rate should enter the Team Tournament. As can be seen in Figure 14 of Appendix B, this corresponds to participants with a task 2 performance above or equal to 6. This is the case of 62% of women and 67% of men. The predicted gender gap is not significant (p=0.69).

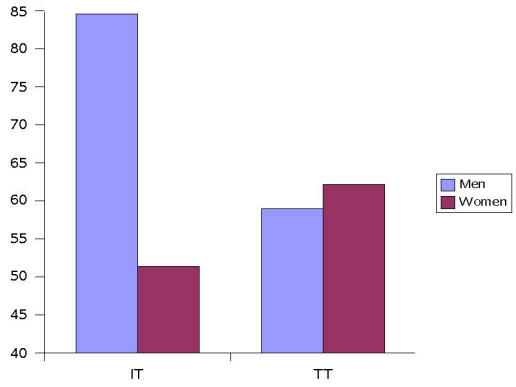

Figure 2. Proportion of entrants men and women in the Individual Tournament (IT) and Team Tournament (TT).

In line with the predictions, the data do not bring any gender gap to light: 62% of women and 59% of men chose to enter the team tournament (p=0.78).

Men enter less than what is predicted by payoff maximizing choices but not significantly less (p=0.49). As can be seen in figure 2, it appears that while women do not choose to enter the tournament significantly more often when it is team-based (p=0.35), men enter significantly less as part of a team than alone (p=0.01).

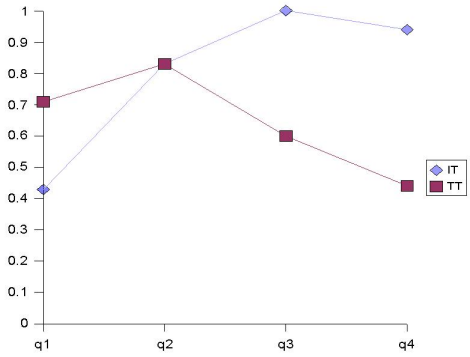

Figure 3. Proportion of men entering the individual and team tournaments conditional on performance level.

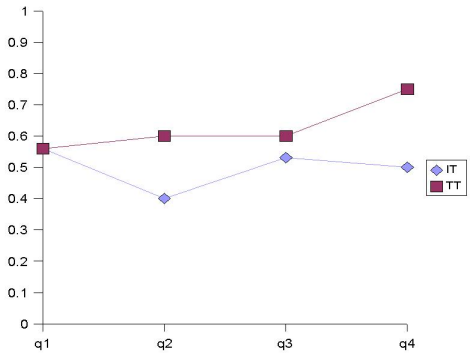

Figure 4. Proportion of women entering the individual and team tournaments conditional on performance level.

Figures 3 and 4 show the percentage of men and women who choose to enter the individual and team tournament conditional on their task 2 performance level. It can be seen that when the tournament is team based, men tend to enter less often for a given probability of winning while women seem to enter a little bit more. It is also noteworthy that the relation between the performance level and the team tournament entry decision is decreasing for men. The logit regression of men's decision to enter the team tournament on the probability of winning (see the Appendix for an explanation of how the probability of winning was computed) provides a negative but only marginally significant coefficient (p=0.0984). The implications of the tournament being team-based rather than individual on the pool of entrants will be discussed in subsection 4.3.

A logit regression of the decision to enter a tournament (task 3 and task 4) on the probability of winning and a team dummy (team=1 for the task 4 decision to enter the Team Tournament and team=0 for the task 3 decision to enter the Individual Tournament) is reported in Table 2. As two observations were used for each participant (task 3 and task 4 decisions to enter each of

Table 2: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Men	Women	All
Female			-0.21
			(0.00)
Female*Team			0.15
			(0.01)
Team	-0.26	0.11	-0.15
	(0.01)	*(0.32)*	*(0.01)*
Prob	0.16	0.12	0.14
	(0.45)	*(0.67)*	*(0.41)*

The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament. p-values are in brackets.

the tournaments), a cluster on the participant was used to take into account the fact that the two decisions to enter the tournaments taken by a same individual are not independent. Conditional on the probability of winning, the fact that the tournament is team-based decreases men's propension to enter while it has no significant effect on women's decision to enter. The probability of winning has no significant effect on either men or women's propension to enter. Overall, participants tend to choose less often to enter the tournament when it is team-based. The positive and strongly significant marginal effect of Female*Team shows that when the tournament is team-based the gender gap in tournament entry is significantly reduced.

3.3 Explanations of the Changes in Tournament Entry between the Individual Tournament and the Team Tournament

The change in the probability of winning does not provide an explanation for the reduction of the gender gap in tournament entry which arises between the individual and the team tournament as both men and women endure the same distortion of the probability of winning. In this subsection, the roles of the other potential explanations cited in section 2 are investigated.

3.3.1 The role of Beliefs

Confidence in one's chances to win the Individual Tournament helped explain one's decision to enter the Individual Tournament. In the Individual Tournament, men were found to be more overconfident in their chances of winning than women. It would be interesting to see whether it is also the case for the team tournament or if the gender difference in overconfidence is reversed when participants are part of a team. For instance, women could feel more confident about their chances of winning when they are paired with a teammate because they could be more optimistic than men about the performance of their teammate. In such a case, this change in beliefs would help explain the reduction of the gender gap in tournament entry. To assess for this potential explanatory power of beliefs on the disappearance of the gender gap in entry in the Team Tournament, we use the dummy Guesswin which equals 1 if the participant's beliefs are consistent with winning the tournament, and 0 otherwise. Remember that a participant knows his absolute performance at each task. For the Individual Tournament, Guesswin equals 1 if the participant thinks his task 2 performance is above average and 0 otherwise. For the Team Tournament, Guesswin equals 1 if the participant's think the sum of his task 2 performance and his teammate's task2 performance exceeds the sum of their opponents'task 2 performances.

Table 3: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Men	Women	All
Female			-0.17
			(0.00)
Female*Team			0.13
			(0.01)
Team	-0.20	0.14	-0.11
	(0.02)	*(0.29)*	*(0.01)*
Prob	-0.17	0.03	-0.03
	(0.45)	*(0.92)*	*(0.86)*
Guesswin	0.39	0.16	0.23
	(0.01)	*(0.33)*	*(0.03)*

The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament and with beliefs consistent with winning the tournament. p-values are in brackets.

The first regression reported in table 3 shows that beliefs help explain men's decision to enter the tournaments. Controlling for beliefs, the coefficient of Team in men's regression is reduced showing that part of the explanation why men enter less often in the tournament when it is team-based comes from men being less confident in their chances of winning the tournament as part of a team than alone. However, since Team remains negative and significant, it must be that other factors account for men's disaffection for the tournament when it is team-based. On the other hand, beliefs are not helpful in explaining women's decision to enter. Overall, a participant whose beliefs are consistent with winning the tournament is 23% more likely to enter than a similar participant whose beliefs are consistent with losing the tournament. Controlling for beliefs, the effect of Female*Team decreases but remains positive and significant. The reduction of the gender gap in overconfidence which occurs when the tournament becomes team-based helps explain the disappearance of the gender gap in tournament entry but other factors must play a role as this change in beliefs do not explain all of it.

3.3.2 The role of general factors: risk, ambiguity and feedback aversion.

A second set of factors mentioned in section 2 which are likely to explain part of the disappearance of the gender gap when the tournament is team-based are general factors such as risk, ambiguity and feedback aversion. To control for these, the decisions to submit the task 1 performance to the individual and team tournaments are used. Indeed, the decisions to enter a given tournament and to submit a past performance to the same tournament are very similar in every aspects except for the fact that only when deciding to enter a tournament does the participant actually have to perform in a competitive environment. Consequently, by adding the decision to submit one can see whether the disappearance of the gender gap occuring when the tournament is team-based is fully accounted for by changes in general factors or if part of it is due to remaining factors ie, changes in how men and women like to perform in a competitive environment and differences in how they like the uncertainty on their teammate's ability.

Table 4 presents the logit regression of the decision to submit task 1 performance to the tournament. Both decisions to submit to the individual and to the team tournaments are used. It can be seen that neither for men nor for women is team significant showing that the fact that the tournament is

Table 4: Logit of submitting a past performance to a tournament (Tasks 3 bis and 4 bis)

Regressors	Men	Women	All
Female			0.00
			(0.48)
Female*Team			0.09
			(0.19)
Team	0.00	0.20	0.07
	(0.84)	*(0.16)*	*(0.87)*
Prob	-0.09	0.57	0.24
	(0.76)	*(0.12)*	*(0.25)*
Guesswin	0.27	-0.05	0.06
	(0.07)	*(0.75)*	*(0.47)*

The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament and with beliefs consistent with winning the tournament. p-values are in brackets.

team-based rather than individual does not influence the decision to submit to a tournament. In particular, men are not less likely to submit a past performance to a tournament when it is team-based while they choose to enter a tournament significantly less as part of a team than alone. In the pooled regression, Female*Team is not significant showing that the fact that the tournament is team-based does not help reduce the gender-gap in submission to the tournament. It must be that factors other than risk, ambiguity and feedback aversion play a role in explaining the disppearance of the gender gap when the tournament is team-based. In the logit regressions presented in Table 5 the decision to submit task 1 performance was added to the regressors to explain the decision to enter the tournament. For both men and women, the decision to submit to the tournament helps explain the decision to enter the tournament. Such is also the case in the pooled regression where it can be seen that compared with someone who decided not to submit, an otherwise similar participant who did submit has a 27% higher chance of entering the tournament.

When adding this new control, men still react negatively to the fact that the tournament is team-based but less so. This suggests that men are more risk, ambiguity and feedback averse as part of a team than alone and it helps explain why they do not enter as often the Team Tournament than they did

Table 5: Logit of Tournament-Entry Decision (Tasks 3 and 4)

Regressors	Men	Women	All
Female			-0.09
			(0.00)
Female*Team			0.06
			(0.02)
Team	-0.11	0.12	-0.05
	(0.00)	*(0.60)*	*(0.00)*
Prob	-0.06	-0.17	-0.12
	(0.77)	*(0.48)*	*(0.40)*
Guesswin	0.21	0.17	0.17
	(0.02)	*(0.22)*	*(0.01)*
Submit	0.25	0.27	0.27
	(0.00)	*(0.00)*	*(0.00)*

The table presents marginal effects computed at a man in the individual tournament with a 50% chance of winning the tournament, with beliefs consistent with winning the tournament and who submitted his task 1 performance to the tournament. p-values are in brackets.

the Individual Tournament. Nevertheless, as the coefficient of Team remains negative and significant, other factors must play a role in men's disaffection for the Team Tournament: men do not enjoy performing in a competitive environment as much when it is a team competition or they dislike the uncertainty on their teammate's ability. As for women, the coefficient of Team as decreased but remains positive and significant showing that women must experience less risk, ambiguity and feedback aversion in the Team Tournament than in the Individual Tournament but it is not enough to explain all of their extra pull for competition when it is team-based. In the pooled regression Female*Team decreased when the decision to submit is added to the regressors but it remains positive and significant. The tournament specific factors explain a significant part of the disappearance of the gender gap in tournament entry: the reduction of the gender gap in risk and ambiguity aversion happening when the tournament becomes team-based is responsible for part of the disappearance of the gender gap in tournament entry. Nevertheless, a part of this disappearance remains unexplained. It could be accounted for by a difference in how men and women like (or, most probably, dislike) the uncertainty about their teammate's ability.

3.3.3 The role of uncertainty about one's teammate's ability.

The effect of one last factor cited has to be controlled for: the taste for influencing one's teammate's payoffs and for having one's teammate influence one's payoffs. In order to do so the task 5 decision to enter the Team Tournament with a teammate of the same level (TTid) is used in addition to the tasks 3 and 4 decisions. The task 5 decision resembles the task 4 decision (team tournament) except for the fact that the uncertainty about the level of one's teammate in the addition task (or at least part of it) is removed since the participant knows that if he enters the tournament he will be matched with a teammate whose task 2 performance is close to his own.

Table 6: Logit of Tournament-Entry Decision (Tasks 3, 4 and 5)

Regressors	Men	Women	All
Female			-0.05
			(0.00)
Female*Team			0.04
			(0.01)
Team	-0.07	0.15	-0.01
	(0.00)	*(0.68)*	*(0.00)*
Prob	0.07	-0.22	-0.04
	(0.60)	*(0.24)*	*(0.71)*
Guesswin	0.24	0.22	0.21
	(0.01)	*(0.06)*	*(0.00)*
Submit	0.29	0.36	0.35
	(0.00)	*(0.00)*	*(0.00)*
IdPartn	0.06	0.08	0.17
	(0.15)	*(0.35)*	*(0.07)*

The table presents marginal effects computed at a man in the Individual Tournament with a 50% chance of winning the tournament, with beliefs consistent with winning the tournament and who submitted his task 1 performance to the tournament. p-values are in brackets.

In the regressions reported in Table 6 the dummy IdPartn equals 1 for the task 5 decision and 0 otherwise. The fact that a participant knows that his teammate will be of a similar level to his own if he chooses to enter the tournament makes it more likely for him to choose to enter. IdPartn helps explain why men do not like team competition suggesting that men's taste for competition decreases when it is team-based. However as Team is still

negative and significant, it must be that the uncertainty on their teammate's ability also explains why men are less drawn to the Team Tournament than they are to the Individual Tournament. As for women, as the coeefficient of Team increases when IdPartn is added to the regressors, it seems that the tournament being team-based makes them like competition more. In the pooled regression, the introduction of IdPartn reduces the coefficient on Female*Team to 4%. Part of the disappearance of the gender gap which occurs when the tournament becomes team-based is due to the fact that when the tournament is team-based a change occurs in how men and women like to perform in a competitive environment probably in the sense of men not liking to perform in a competitive environment as much when part of a team. Nevertheless, as the coefficient on Female*Team remains significant, part of the disappearance of the gender gap is not accounted for by a different impact of the tournament being team-based on men and women's taste for evolving in a competitive environment but must be attributed to the fact that men do not like the uncertainty on their teammate's level when having to perform in a team competition.

4 Consequences on welfare of the tournament being team-based rather than individual.

The introduction of the team tournament was successful in wiping out the gender gap in tournament entry. It is obviously essential to closely study the consequences of the team tournament on other aspects in order to weigh up the pros and cons. This section studies the consequences of the type of tournament on participants' payoffs as well as on the pool of entrants and its quality, ie, the performance of those who choose to enter. It allows to draw some conclusions on the implications of the choice of a type of competition on both contestants and head-hunters.

4.1 Consequences of the type of tournament on the probability of winning and expected payoffs

The consequences of the tournament being team-based on the quality of the pool of entrants and their payoffs will depend on the change in the probability of winning and expected payoffs all other things being equal but also on the

change in behavior which in turn has an impact on the probability of winning and expected payoffs. Remember that when entering the Team Tournament a participant knows that he will be matched with a teammate who also chose to enter the team tournament. Hence, the level of other participants who chose to enter has an impact on a participant's probability to win if he enters as well as on his payoffs if he enters and wins (as each teammate of the winning team earns 1 euro times the average performance of the team). First of all, let us look at figures 5 and 6 which represent respectively the probability of winning and the expected payoffs for each of the 3 tournaments conditional on performance (the details of the computations are provided in Appendix A.

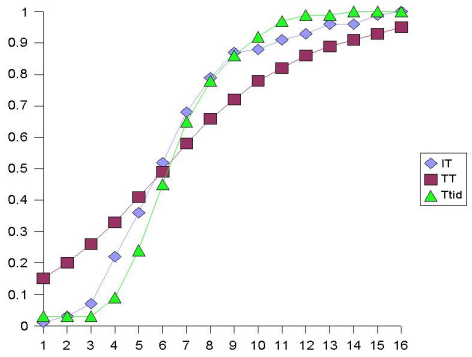

Figure 5. Probability of winning the tournaments conditional on performance.

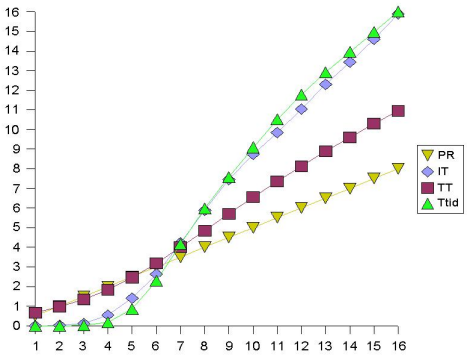

Figure 6. Expected payoffs of the tournaments conditional on performance.

It can be seen that while for the individual and the team tournament with a teammate of the same level both the probabilities of winning and the expected payoffs are close such is not the case for the Team Tournament. Indeed, the Team Tournament provides higher expected payoffs than the 2 other tournaments for low-performing participants and lower expected payoffs for high-performing participants. When taking the actual pool of entrants of the Team Tournament to calculate the probabilities and expected payoffs of an entrant conditional on his performance the results are really similar.

The average task 2 performance of the team Tournament entrants (6.52) is lower than the average task 2 performance of the whole group (6.86) but it is far from being significant. Nevertheless this is not unexpected as the dif-

ference of performance between those who did choose to enter and those who did not is not significant (a two-sided Mann Whitney test yields p=0.30) implying all the more that the difference of performance between the entrants and the whole group is not significant either. The fact that the Team Tournament implies a transfer of payoffs from high-performing to low-performing participants casts some doubt on whether it is appropriate from an ethical point of view. Notice that the Team Tournament with a teammate of the same level has the huge advantage of almost not distorting the probabilities of winning and expected payoffs of the individual tournament.

4.2 Consequences on participants' payoffs

Figure 7 shows the payoffs of men and women corresponding to the 3 kinds of tournaments [1].

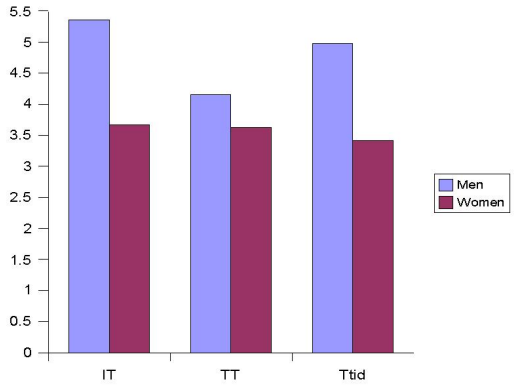

Figure 7. Payoffs of men and women for the 3 tournaments.

The gender payoff gap is marginally significant for the individual tournament and the team tournament with a teammate of the same level (p=0.11 each time with a two-sided Mann-Whitney test) but it is far from being significant (p=0.33) for the team tournament. The disappearance of the gender gap in payoffs occuring in the Team Tournament comes nevertheless with a cost as men undergo a decrease in their payoffs why women's payoffs remain

[1]For a participant who chose the piece rate it equals 0.5 times his or her performance while for a participant who chose the tournament it equals his expected payoff given his performance.

stable (due to high-performing men not entering the tournament when it is team-based). It is then worth wondering whether this dumbing down of payoffs is too high a price for gender equality. Notice that providing information on one's teammate's ability is enough to see men's payoffs go up again increasing in turn the gender payoff gap.

4.3 Consequences of the type of tournament on the quality of the pool of entrants

A question crucial to our interest is how the type of tournament influences the quality of the pool of entrants. Figure 8 represents the percentage of participants who chose to enter each of the 3 tournaments conditional on task 2 performance level. Compared with the Individual Tournament, more low-performing and fewer high-performing participants choose to enter the Team Tournament. This obviously affects the average performance of the entrants even though the difference in performance between the entrants of the individual and team tournament is not significant (p=0.18 for the two-sided Mann Whitney test and p=0.09 for the one-sided test). On the other hand, the proportion of entrants of each performance level in the TTid is similar to the proportion of entrants in the Individual Tournament.

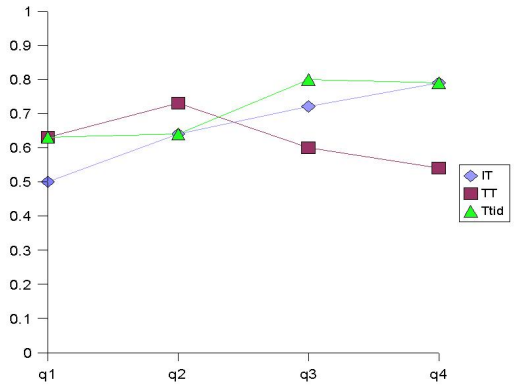

Figure 8. Proportion of entrants in the tournaments conditional on performance level.

Looking at figures 9 and 10, it can be observed that the quality of the pool of men entrants is deteriorated when the tournament becomes team-based. However, this shortcoming is overcome when one entrant knows that

his teammate will be of ability close to his own as it is the case in the TTid. As for women, they seem to enter a little bit more whatever their performance level when the tournament is team-based. Furthermore, whether they know something about the ability of their teammate does not change much their propensity to enter.

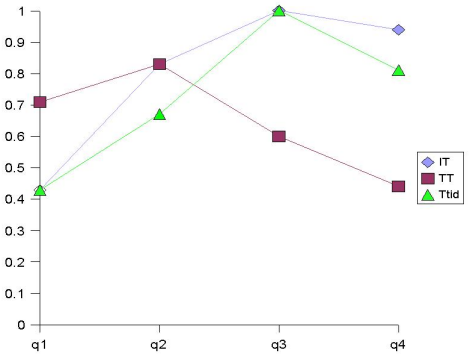

Figure 9. Proportion of men entering the tournaments conditional on performance level.

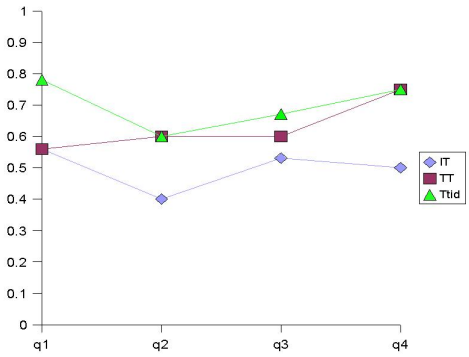

Figure 10. Proportion of women entering the tournaments conditional on performance level.

Figure 11 shows the average performances of men and women entrants in the 3 kinds of tournaments. Each time, men are slightly better than women but not significantly so. We can observe a decrease of men's performance when the tournament becomes team-based which is however not significant. It may be due to men shirking when part of a team but it may also be caused by the crowding out effect of the team tournament on high-performing men. Women entrants' performance on the other hand is very stable across tournaments. In consequence, the fact that the tournament is team-based does not negatively affect women's performances. Still, the average performance of entrants is lower under the Team Tournament (6.48) than under the Individual Tournament (7.48). Men's performance goes up again when participants know that they will be matched with a teammate of the same level.

In order to check whether male entrants' average performance is lower under the team tournament than under the individual tournament because of shirking behaviors, I look at differences in performance of men who chose to enter the Team Tournament between the 3 kinds of tournaments. In figure 12 it appears that there is almost no difference in the performance of men who chose to enter the team tournament between the individual and

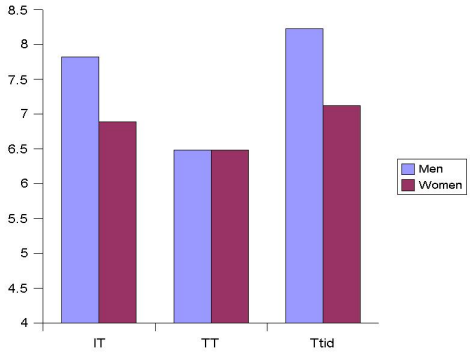

Figure 11. Performances of men and women entrants in the 3 tournaments.

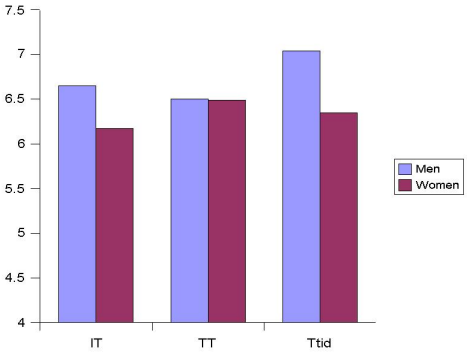

Figure 12. Performances of men and women *who chose to enter the TT* in the 3 tournaments.

the team tournament. I can therefore rule out shirking as an explanation for the decrease in performance of men entrants between the individual and the team tournament. The remaining explanation is the crowding out effect of high-performing men when the tournament is team-based and participants do not know anything about their teammate's ability. It seems to suggest that high-performing men's distate for the Team Tournament comes from their not wanting to help a less deserving participant get a higher payoffs and they seem ready to give up some of their payoffs to prevent that from happening.

Team competition seems to be the solution to get a gender-balanced pool of tournament entrants. Nevertheless, the uncertainty about their teammate has a crowding out effect on high-performing men, while low-performing men are prompted to enter. Providing information about one's teammate's ability seems to be the condition to make the gender gap in tournament entry disappear without deteriorating the average ability of entrants. However it has the downside of keeping the gender payoff gap as it is in the Individual Tournament.

5 Conclusion

This paper aims at studying the effect of a tournament being team-based rather than individual on the gender gap in tournament entry. While a large and significant gender gap in entry in the Individual Tournament is found in

line with NV and NSV, no gender gap is found in entry in the Team Tournament. While women do not choose to enter the tournament significantly more often when it is team-based, men enter significantly less as part of a team than alone. A first explanation is a reduction of the gender gap in overconfidence occuring when subjects are part of a team (men are less overconfident when part of a team than alone). Another explanation lies in a change in risk, ambiguity and feedback aversion: women become less risk, ambiguity and feedback averse when part of a team than alone and men become more risk, ambiguity and feedback averse. Another part of the disappearance of the gender gap is due to men not liking the uncertainty on their teammate's ability. The remaining explanation is that being part of a team changes how men and women like to perform in a competitive environment. While men like evolving in a competitive environment more than women in an individual competition, this is less the case in a team competition, women enjoying competition more when they have a teammate and men losing part of their interest in competition when part of a team.

This paper therefore helps get a better understanding of why men tend to like competition more than women. It seems that part of the gender gap in the taste for evolving in a competitive environment comes from a difference in how men and women like to be alone at the top. When men know that they will have to share the glory of their victory with a teammate if they win the competition, they are perceptibly less likely to engage in it. This could help find a solution to the harmful consequences of men's overconfidence in certain fields such as finance where being blinded by the perspective of earning millions can lead to take too much risk and lose everything.

This experiment also provides a way of wiping out the gender gap in tournament entry. However, when looking closer at the consequences of the tournament being team-based on welfare aspects, it appears that it negatively affects the quality of the pool of entrants by crowding out the high-performing men from tournament entry. High-performing men seem to be repeled by the uncertainty on their teammate's ability or by the idea that they might help a less deserving participant get higher payoffs by entering the Team Tournament and as a result they choose not to enter the Team Tournament even if it means getting lower payoffs. In turn, the average payoff of entrants decreases when the tournament is team-based. There is nevertheless a way of getting a gender-balanced pool of entrants without driving away high-performing men from competition by providing contestants with information about their teammate's ability namely, telling them they will be matched

with a teammate of level close to their own.
Obviously, teams cannot be implemented in every real-life situations where competition is present: when a firm is willing to hire, the screening process needs to be an individual one in order to make sure the most deserving applicants are chosen. Nevertheless, enabling students to work in teams or advertising for the fact that a large part of a job will induce team-working may help get a more gender-balanced pool of applicants to top-level universities or high-profile jobs. If such is the case, allowing applicants to choose their teammate may avoid scaring off high-performing men from applying.

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Appendices

A Differences between individual and team tournaments

For a given performance, the probability of winning the individual and team tournament are not the same. Figure 1 [2] shows for both types of tournament the probability of winning conditional on performance. It can be seen that low-performing participants have a higher probability of winning the team tournament than the individual tournament while the opposite is true for high-performing participants.

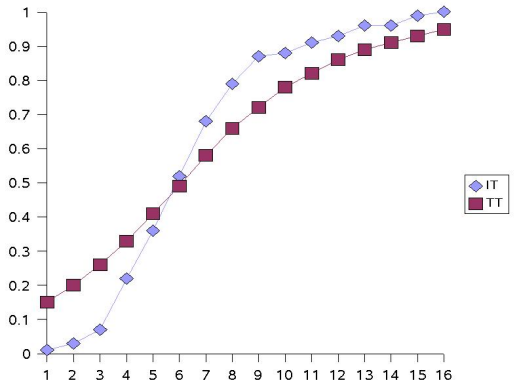

Figure 13. Probability of winning the individual and team tournaments conditional on performance.

In addition to the probability of winning, what also changes between the individual and team tournament is the expected payoff for a given performance as shown in Figure 14 [3]. It can be seen that low-performing partici-

[2] 1.000.000 pairs of opponents'performances and 1.000.000 teammate's performances were drawn by sampling with replacement from the task 2 performances of the 76 participants. For each level of performance, the probability of winning the individual tournament was computed by calculating the number of times out of 1.000.000 this given performance exceeded the first opponent's performance. Similarly, for each level of performance, the probability of winning the team tournament was computed by calculating the number of times out of 1.000.000 this given performance plus the partner's performance exceeded the sum of both opponent's performances.

[3] 1.000.000 pairs of opponents'performances and 1.000.000 teammate's performances

pants have higher expected payoffs from entering the team tournament than the individual tournament while the opposite is true for high performing participants. This makes sense as if a low-performing participant wins the team tournament, his payment depends on the average performance of his team which is likely to exceed his own performance. On the contrary, if a high-performing participant wins the team tournament, his payment depends on the average performance of his team which is likely to be lower than his own performance.

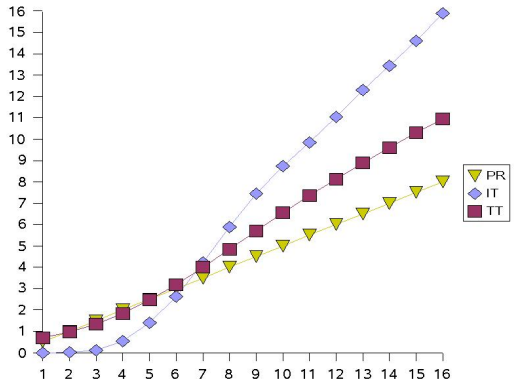

Figure 14. Expected payoffs of the piece rate and individual and team tournaments conditional on performance.

Notice that in the present experiment participants do not face at any point a choice between the individual and team tournaments but only between each of these and the piece rate remuneration scheme (0.5 euro per correct addition). In consequence, if he expects his tasks 3 and 4 performances to be the same as his task 2 performance, a payoff-maximizing participant should choose the individual tournament if his task 2 performance is at least 7. Similarly, a payoff-maximizing participant should choose the team trournament if his task 2 performance is above or equal to 6.

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were drawn by sampling with replacement from the task 2 performances of the 76 participants. For each level of performance, the expected payoff from entering the individual tournament was computed in the following way. For each given performance, the payoff corresponding to each of the 1.000.000 first opponent's performances was computed and averaged. Similarly, for each level of performance, the expected payoff from entering the team tournament was computed by calculating the payoff corresponding to each of the 1.000.000 different sets of 1 teammate's and 2 opponents's performances and averaging it.

B Tasks and What They Control For

The following Table is a synthesis of the Tasks participants had to complete, how they compare to other tasks and what they allow to control for.

Table 7. Tasks and What They Control For

Tasks	1	2	3	3 bis	4	4 bis	5	5 bis
Remuneration Scheme	Piece Rate (PR)	Tournament (IT)	Piece Rate vs Tournament	**Submit** Task 1 perf to Piece Rate vs Tournament	Piece Rate vs Team Tournament (TT)	**Submit** Task 1 perf to Piece Rate vs Team Tournament	Piece Rate vs Team Tournament with a teammate of same level (TTid)	**Submit** Task 1 perf to Piece Rate vs Team Tournament with a teammate of same level
Link to other Tasks			Choice Between Task 1 and Task 2	=Task 3 Except No Performance Needed	=Task 3 Except the Tournament is Team-based	= Task 4 Except No Performance Needed	= Task 4 + info about Teammate's Performance	= Task 5 Except No Performance Needed
Controls for	Benchmark and Ability Measure	Benchmark and Ability Measure	Gender Gap in IT	Risk, Ambiguity, Feedback Aversion	Gender Gap in TT	Risk, Ambiguity, Feedback Aversion	Taste for Uncertainty on Teammate's Ability	Risk, Ambiguity, Feedback Aversion